configuration of this embodiment, if the projective-capacitive system does not confirm that a valid touch has occurred, the system is simply returned to the stand-by mode. In an alternate configuration, if the touch is invalidated, the system adjusts the threshold of the force sensors (step **1009**). For example, the required force threshold can be increased, thus avoiding false touches (e.g., false touches due to wind). Preferably if the force threshold is adjusted to compensate for false touches, periodically the threshold is automatically decreased thus accounting for decreasing noise (e.g., decreasing wind noise) and providing optimal touch sensitivity. Besides setting the threshold on the force sensors'amplitude, the frequency spectrum of the background can also be monitored, thus allowing the use of suitable frequency filters as required. In this configuration, if a false touch is detected with the projective-capacitive sensors, the background frequency spectrum can be evaluated and an appropriate frequency filter applied. As in the case of the force threshold, preferably the frequency filter is periodically relaxed or the frequency spectrum is periodically remeasured, thus insuring that unnecessary filtering is not applied.

In one embodiment of the invention, both the projective-capacitive and force touch sensor systems are capable of providing touch position coordinates. In this embodiment the system touch algorithm is designed to determine which sensor system is likely to provide the most accurate position for the given conditions. The system then obtains touch coordinates from the designated system. FIG. **11** illustrates the method used with this dual sensor system.

Initially the touch system is in a stand-by mode (step **1101**). Preferably the initial touch is detected by the force sensors (step **1103**), thus avoiding the proximity errors that can occur with the projective-capacitive sensors. Once a touch has been detected and confirmed with the secondary sensor system (i.e., the projective-capacitive sensors in the preferred embodiment) (step **1105**), the touch algorithm adjusts the threshold of the projective-capacitive sensors in order to overcome differences in finger size or conductivity (step **1107**). Since both sensors provide full positional accuracy, the next step is to determine the offset between the two touch positions registered by the two sensors (step **1109**). If the offset is greater than is reasonable (i.e., greater than can be accounted for due to wind, hand size, etc.), the system invalidates the touch and returns to stand-by mode. If the offset between the two touch positions is within acceptable limits, the touch is verified and the process continues.

The touch algorithm next determines which touch sensor to use in determining touch coordinates (step **1111**). For example, the touch algorithm can recognize that the system is being used in a drag mode by determining that the touch position is changing prior to an untouch message being sent (step **1113**). In this instance. preferably the projective-capacitive system is used to determine both touch position and the location at which untouch occurs (step **1115**) since this system is generally better suited for supporting the drag mode as noted above. Alternately, if the system determines that the vibrational or wind generated background noise is too great (step **1117**) the touch algorithm can select the projective-capacitive system to provide touch positions (step **1119**). Otherwise the force sensors can be used to determine touch position (step **1121**).

In a slight modification of this embodiment, if the projective-capacitive sensors do not confirm the touch initially detected by the force sensors (step **1105**), the system can adjust the force sensor thresholds (step **1123**) prior to returning the system to the stand-by mode. As noted with reference to FIG. **10**, either the amplitude threshold or the frequency filter for the force sensors can be adjusted.

Besides overcoming the deficiencies of both sensor systems, the combination of sensors described above has other advantages. For example, in the system stand-by mode, only one of the sensor systems needs to be in the ready state. Thus the other sensor system can be in a completely unpowered state, thereby reducing power consumption. For example, the force sensors can remain in the alert state and, once triggered, the projective-capacitive electrodes can be scanned.

Another advantage of the above combined sensors is the possibility of obtaining limited user identification. For example, a right-handed user, due to the capacitance of the user's hand, tends to project a touch position with the projective-capacitive system that is to the right of the point of contact as determined by the force sensors. Similarly, a left-handed user tends to project a touch position that is to the left of the point of contact as determined by the force sensors. Other touch attributes that can be used in an identification system are offset between the touch positions determined by the two systems, the force used to touch the screen, the speed at which the user touches multiple areas on the screen, and the time between a user's initial touch and their untouch. The system can be designed to monitor only certain touch strokes (e.g., user code for an ATM machine), or all touch strokes. One potential use of the data is to provide different users with different menus, touchscreens, etc. based on past use.

The use of multiple touch sensors typically does not require multiple sets of electronics since much of the electronics associated with a touchscreen controller is independent of the type of detector. For example, a typical touchscreen controller requires a microprocessor, RAM, ROM, an analog-to-digital converter (ADC), power supply circuitry, digital circuits to support communication with the host computer, and a printed circuit board. Thus in many cases much of the electronics associated with the touchscreen can be used to support multiple sensor systems.

In some instances, other aspects of the controller electronics may be common to two different types of sensors. For example, some types of piezoresistive force sensors can be read out with an alternating-current excitation voltage in the tens of kiloHertz range as opposed to the more typical approach of using a direct-current excitation voltage. Therefore the same excitation frequency and similar receive electronics can be used for both the force sensors and the projective-capacitive sense electrodes.

FIG. **12** is an illustration of a generic block circuit diagram for a sensor element readout circuit **1200**. Negative feedback assures that the voltage on a feedback line **1201** is the same as the oscillating voltage V_0 produced by a reference **1203**. The output from a sensor element **1205** is the signal voltage ΔV superposed on the reference voltage V_0. The output line plus a reference voltage line provide a differential signal output voltage ΔV.

FIG. **13** illustrates a projective-capacitive sensor element for use with the circuit of FIG. **12**. A variable capacitor **1301** represents the projective-capacitive sensor electrode. In use, a user's finger or other grounded object causes the capacitance to ground to be increased. A resistor **1303** supports the readout scheme. Resistor **1303** can either be built directly into the sensor or located with the readout electrodes.

The feedback circuit illustrated in FIG. **12** can also be used with the alternating current readout of a force sensor.